An Update on the Status of the IECC/IRC -or- What the *RICC* Means to Me

Z. Todd Taylor
Pacific Northwest National Laboratory
presented July 21, 2004
to the National Workshop on State Building Energy Codes

Overview

- Background and History
- What the RICC changed in the IECC and IRC
- Implications of those changes (what they likely mean to you and me)

BACKGROUND AND HISTORY

RICC Background and History

DOE's Residential IECC Code Change…

…is no more!

It's now the *2004 Supplement to the 2003 IECC*

RICC Background and History, cont'd.

- Why

  Two main comments:
  - Code is too complex
  - Code doesn't accommodate cooling concerns
- How
  - Engage all interested parties
  - Completely rewrite the code

"*A substantial improvement in usability*"

RICC Background and History, cont'd.

- 1st Hearing
  - No speakers in opposition
  - New IRC approved with only minor "floor mods"
  - New IECC approved with more significant floor mods
    - Wall R-values increase in north
    - Glazing U/SHGC trade-off limits tightened
    - Prescriptive table deleted
    - Glazing area baseline (18%) removed from performance path

RICC Background and History, cont'd.

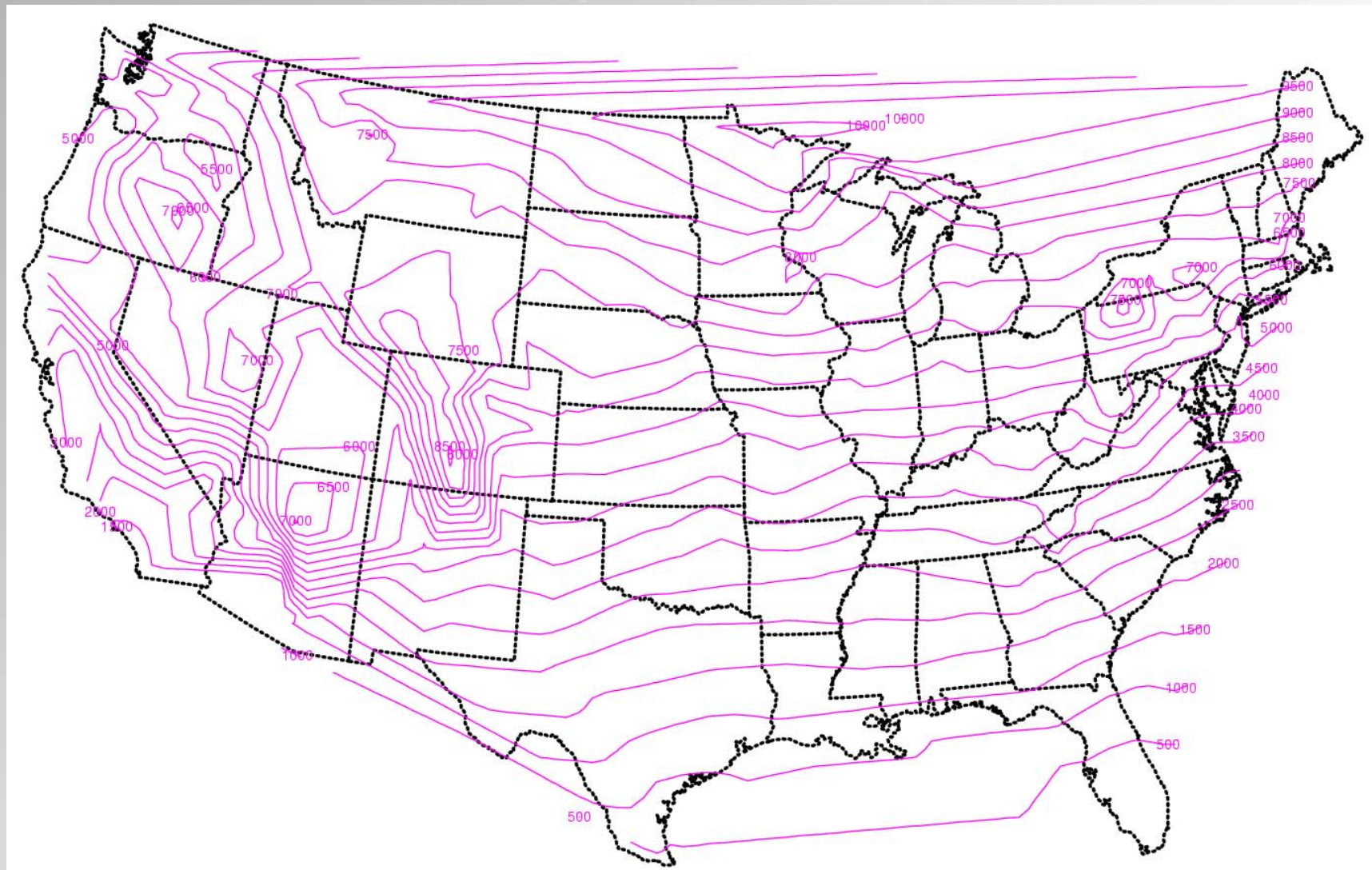
- 2nd Hearing
  - DOE's "public comments" realigned IECC and IRC (partially/mostly)
  - All of DOE's public comments accepted
  - No other public comments accepted
  - Overall proposal easily received the required 2/3 majority vote (plus a round of applause ☺)
  - Result is the *2004 Supplement to the 2003 IECC*
  - Proposals for next cycle due August 20

WHAT CHANGED

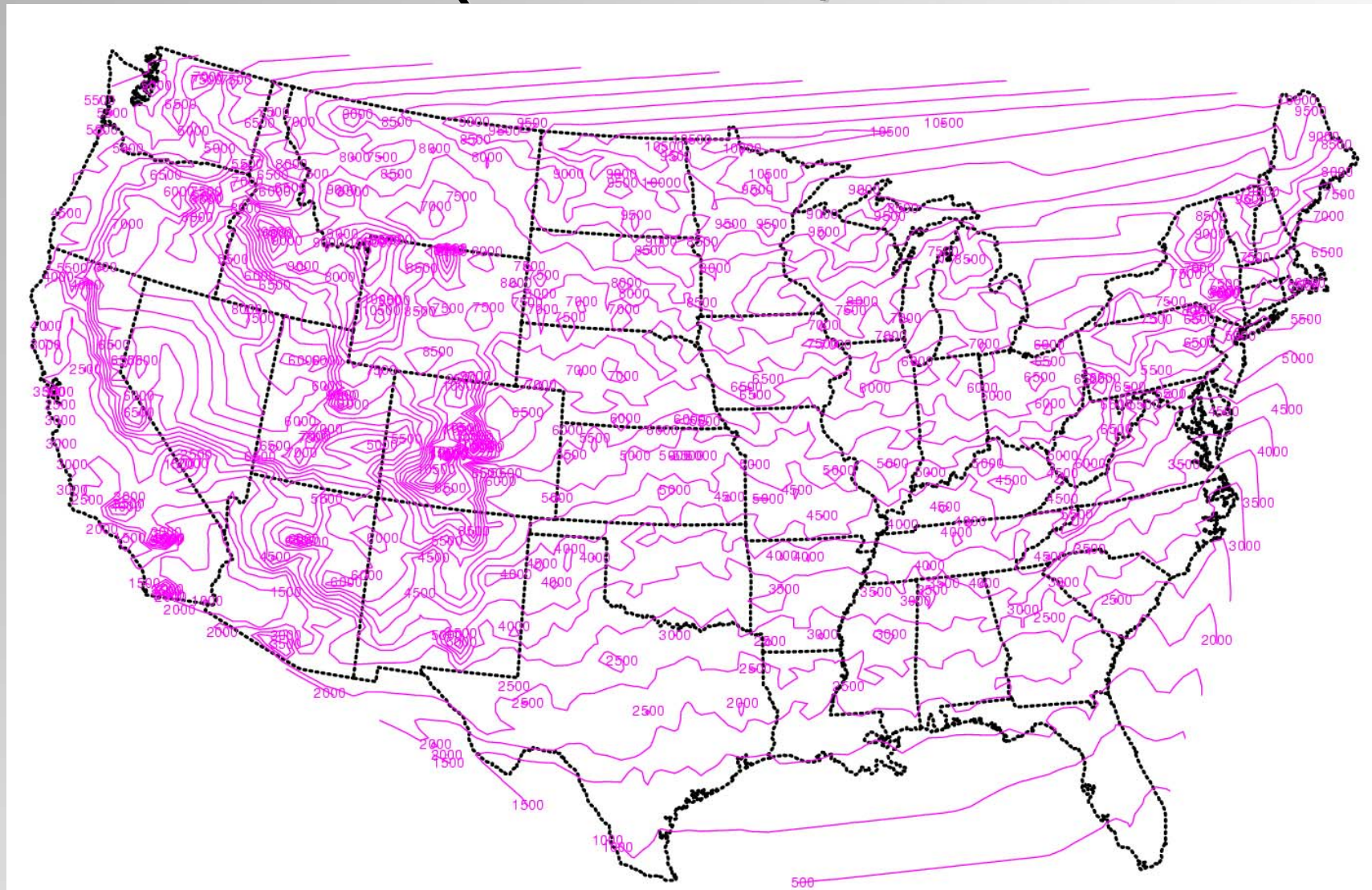
What Changed—New Climate Zones

- Defined geographically, not climatically
- Political boundaries honored (state, county lines)
- Metropolitan areas kept together
- Number of zones reduced from 19 to 8

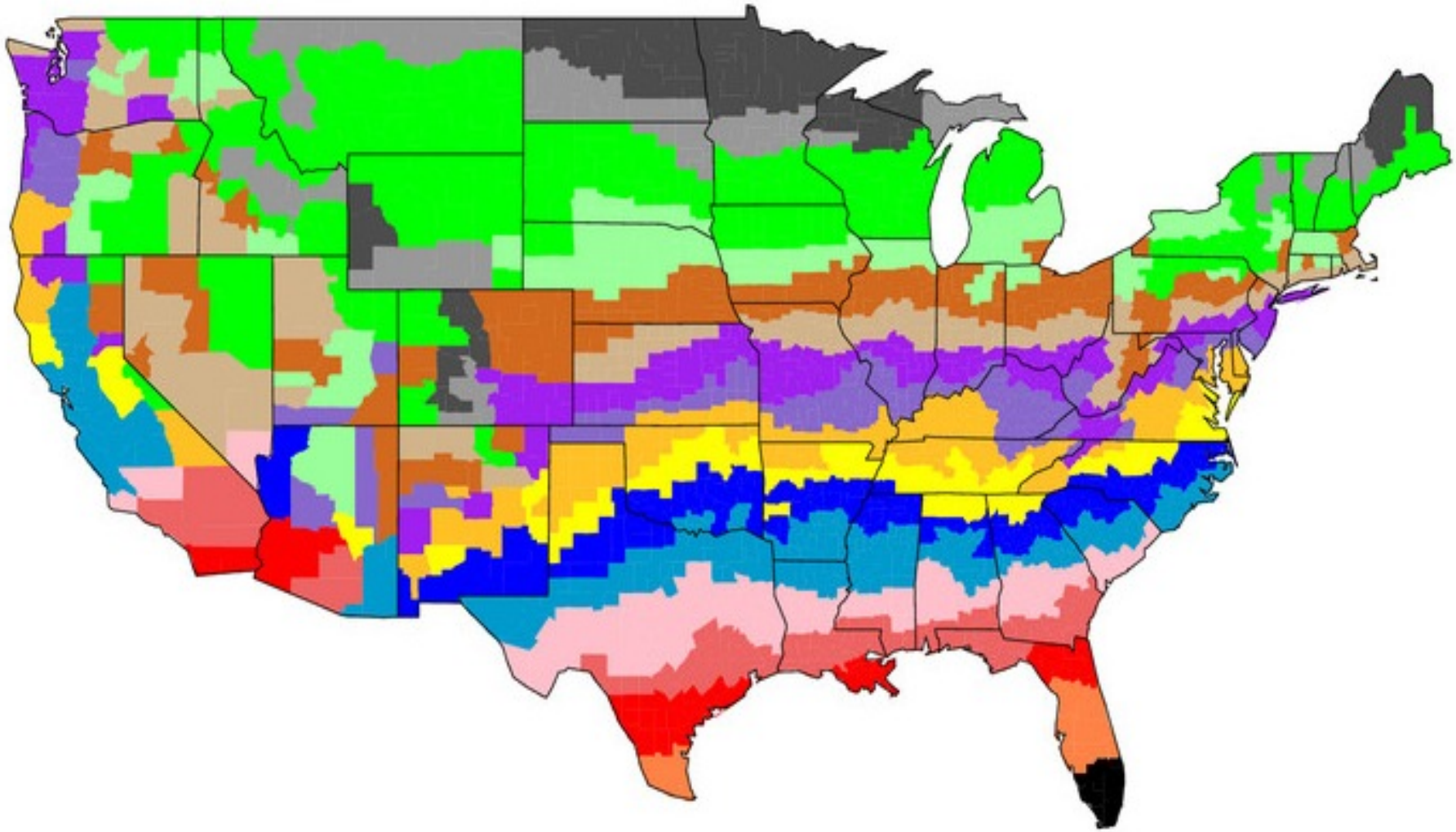
HDD65 (based on 239 SAMSON sites)



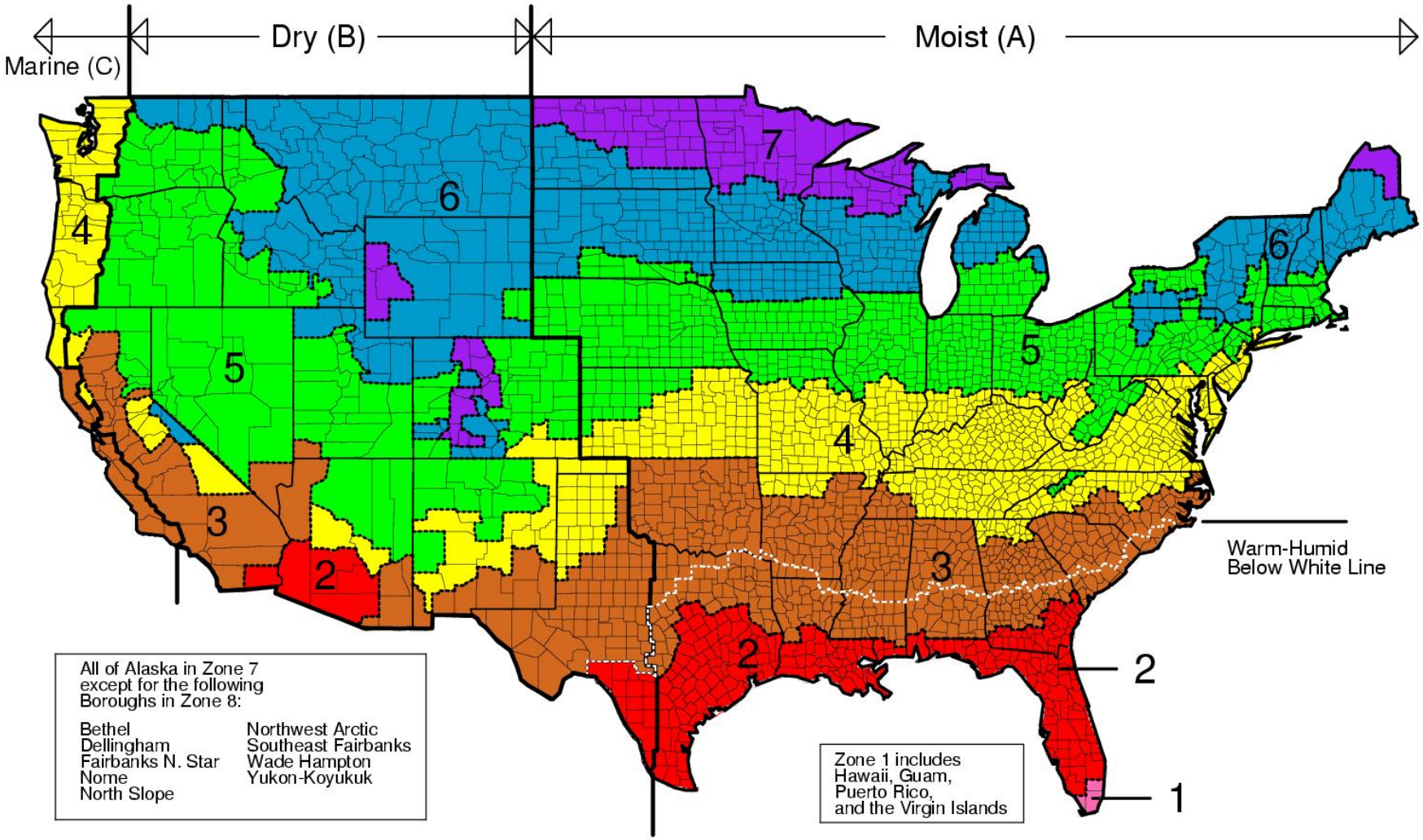
HDD65 (based on 22,154 USGS locations)



Current IECC Climate Zones (by County)



Map of DOE's Proposed Climate Zones



March 24, 2003

What Changed—No Dependency on Glazing *Percentage*

- Previous code raised/lowered stringency of other house elements depending on window-wall ratio
  - High-WWR houses had to improve R-values/U-factors or use performance path
  - Low-WWR houses (the majority) got to back off R-values/U-factors
  - Net result was a code looser than it appears, at a substantial cost in complexity
- New code maintains the same R-values and U-factors regardless of window area percentage

Code Requirements Comparison with Various Window-Wall Ratios (Philadelphia)

IECC Version	WWR (%)	Ceiling R-value	Wall R-value	Floor R-value	Glazing U-factor
2003	8	30	13	15	0.55
	12	38	14	19	0.50
	15	38	16	19	0.45
	18	38	15	19	0.37
	20	38	16	19	0.37
	25	38	19	19	0.33
2004	Any	38	15	19	0.40

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	20	38	16	19	0.37
	25	38	19	19	0.33
2004	Any	38	15	19	0.40

What Changed—No Dependency on Glazing *Percentage*, cont'd.

- Several irrational behaviors eliminated
  - Larger house could comply with lower efficiency
  - Increasing wall area (e.g., 10-foot ceilings) allowed compliance with lower efficiency
- Ambiguities and difficulties eliminated
  - What is the real wall/floor area under an A-frame?
  - What are dormer walls?
  - What are knee walls?
  - Mansard roofs?
- Elimination of *percentage* calculations reduces code's complexity by an order of magnitude

What Changed—Main requirements are now in one table

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40	30	15	5	19	0	0	5 / 13
4 except Marine	0.40	0.60	NR	38	15	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	21 or 15+5[g]	13	30[f]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	21 or 15+5[g]	15	30[f]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10 /13	10, 4 ft	10 / 13

Note: For any zone, the primary code consists of ten numbers

What Changed—Cooling Considerations Incorporated

- New climate zones were developed with cooling (as well as heating) in mind
  - Efficiency requirements no long tend toward “zero” at very-low HDD
  - Framework included for moisture discrimination
    - Three moisture regimes (moist, dry, marine)
    - ASHRAE-defined “humid” region explicitly called out
- Ceiling (and some wall) R-values made higher in south
- Vapor retarder requirements moved north

What Changed—Conditioned Attics Explicitly Allowed

- …if there is no interior vapor retarder (in the attic "floor")
- …if air-impermeable insulation is in direct contact with underside of roof deck (in most zones)
- …with special provisos in "warm humid" locations
- …if sufficient insulation is present to maintain condensing surface T ≥ 45F (in northern zones)

What Changed—Lots of little things

- Doors & windows have the same U-factors—no more wrangling over when a glass door is a window
- Door/glazing defaults simplified and improved
- Air handlers must be sealed
- An “energy certificate” must be posted
- All 2x6 wall requirements have 2x4 alternatives
- Slab-edge insulation not required in high-termite regions

What Changed—Lots of little things, cont'd.

- Floor insulation required to contact floor
- Most cathedral ceilings require no more than R-30 unless framing members will accommodate it
- Similar limits on floor cavities
- Mass wall and steel frame provisions are greatly simplified and improved
- Pipe insulation requirements greatly simplified
- Convenient exemptions allowed for small decorative elements (doors, sidelites, etc.)

What Changed—Lots of little things, cont'd.

- No distinction between single- and multi-family
- Impossible-to-enforce requirements eliminated
  - Pool heaters
  - Text on equipment efficiencies
  - "Air transport factors"
  - Heat traps
  - Etc.
- Exemplary beyond-code programs can be explicitly acknowledged

What Changed—New Performance Path

- Based on a simple, foundational statement of principle
- Formatted to be readable by modelers and mortals alike
- Eliminates ***most*** ambiguities, inconsistencies, and superfluities
- Aligns more closely with RESNET's HERS rules

RICC Performance Path—Foundational Statement of Principle

404.5.1 General. Except as specified by this Section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

Table 404.5.2(1) Specifications for the Standard Reference and Proposed Designs

Building Component	Standard Reference Design	Proposed Design
Above grade walls:	*Type: wood frame* *Gross area: same as proposed* *U-Factor: from Table 402.1.2* Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement and crawlspace walls:	*Type: same as proposed* *Gross area: same as proposed* *U-Factor: from Table 402.1.2 with insulation layer on interior side of walls*	As proposed As proposed As proposed
Above grade floors:	*Type: wood frame* *Gross area: same as proposed* *U-Factor: from Table 402.1.2*	As proposed As proposed As proposed
Ceilings:	Type: wood frame Gross area: same as proposed U-Factor: from Table 402.1.2	As proposed As proposed As proposed
Roofs:	Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics:	Type: vented with aperture = 1ft^2 per 300 ft^2 ceiling area	As proposed
Foundations:	Type: same as proposed	As proposed
Doors:	Area: 40 ft^2 Orientation: North U-factor: same as fenestration from Table 402.1.2	As proposed As proposed As proposed
Glazing: [a]	Total area [b] =18% of conditioned floor area Orientation: equally distributed to four	As proposed As proposed

		combined with the mechanical ventilation rate,[f] which shall not be less than 0.01 x CFA + 7.5 x (N_{br}+1). where: CFA = conditioned floor area N_{br} = number of bedrooms
Mechanical ventilation:	*None, except where mechanical ventilation is specified by the proposed design, in which case:* Annual vent fan energy use: kWh/yr = 0.03942*CFA + 29.565*(N_{br}+1) where: CFA = conditioned floor area N_{br} = number of bedrooms	As proposed
Internal gains:	IGain = 17,900 + 23.8*CFA + 4104*N_{br} (Btu/day per dwelling unit)	Same as standard reference design
Internal mass:	An internal mass for furniture and contents of 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element [g] but not integral to the building envelope or structure.
Structural mass:	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air; For masonry basement walls, as proposed, but with insulation required by Table 402.1.2 located on the interior side of the walls; For other walls, for ceilings, floors, and interior walls, wood frame construction.	As proposed As proposed As proposed

What Changed—IECC and IRC (mostly) aligned

- IRC still has no performance path (by design)
- Floor mods left R-value tables different

What Changed—Commercial Updates

- Requirements re-mapped to new climate zones
- Envelope tables simplified

IMPLICATIONS

Implications

"Your code book will shrink by half."

—Craig Conner at ICC Spring Hearing

Implications—Much easier to enforce

- No calculations (can almost do inspections based on materials delivered to site)
- Plan review practically unnecessary unless trade-offs are used
- Inspections much easier—fewer departures from normal
- Most in-the-field design changes require no energy approval from code official
- Modifications/additions no longer a headache

Implications—This code has teeth

- Readable by builders, code officials, efficiency advocates, lobbyists, even politicians
  - More likely to be understood
  - More likely ***expected*** to be enforced
  - More likely to be enforced
- No more “giving away the farm” on low-glazing-percentage houses
- Fewer free-rider bypasses in the performance path

Implications—Your jurisdiction has a new zone

- Consequently, stringency may change slightly
- Number dropped from 19 to 8, meaning it's likely your region will have fewer zones
- Because HDD doesn't map directly to County, there is no "formula" to map from old to new—but none is needed

…next slide shows counts of "cities" moving from each old zone to each new zone

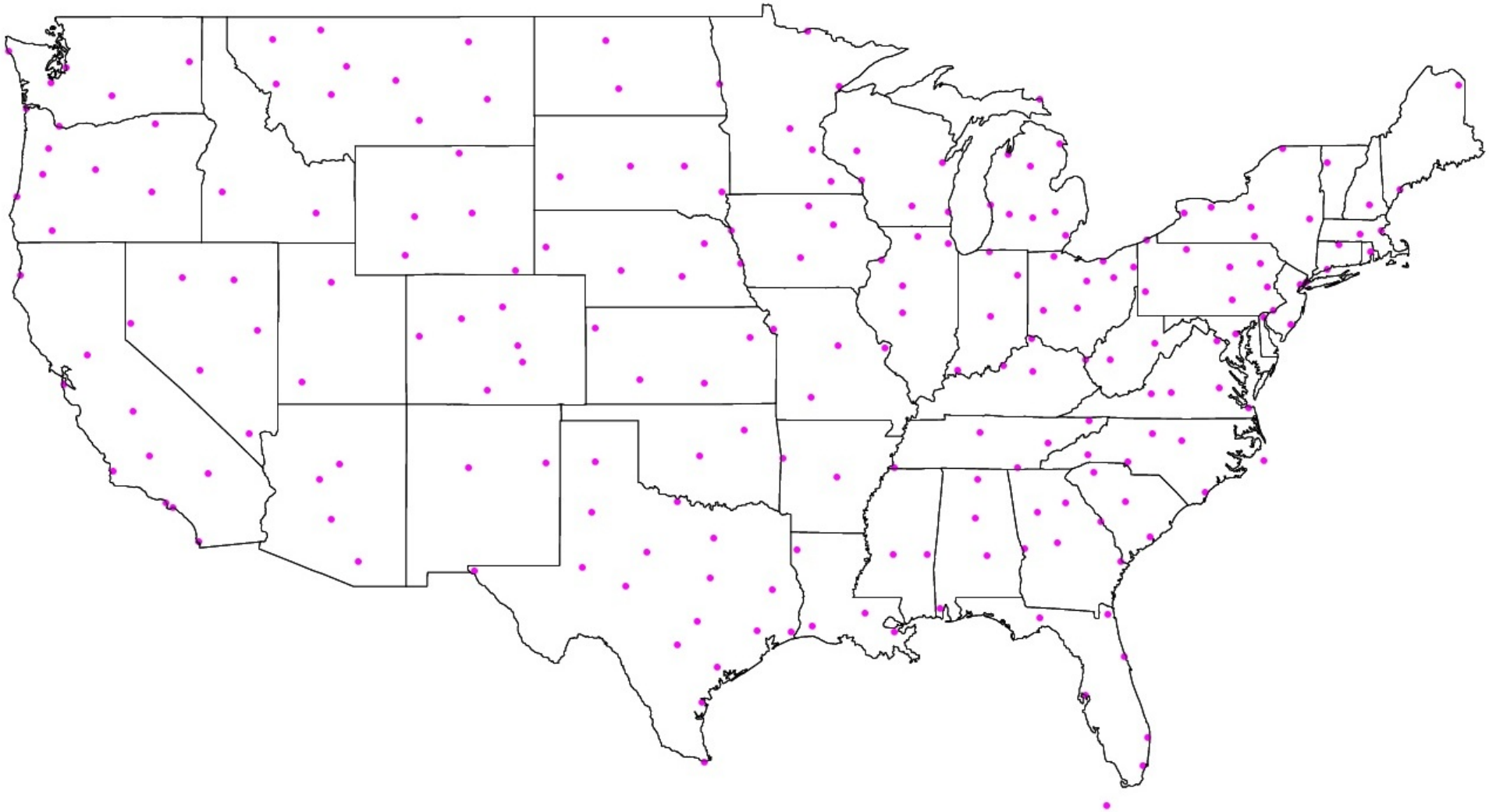
Mapping from HDD-based Zones to New Zones

	1	2	3	4	5	6	7	8
1	799	250	0	0	0	0	0	0
2	0	1481	0	0	0	0	0	0
3	0	2756	227	0	0	0	0	0
4	0	5305	2052	0	0	0	0	0
5	0	1031	6410	0	0	0	0	0
6	0	0	13405	0	0	0	0	0
7	0	0	10764	1299	0	0	0	0
8	0	0	3768	7419	0	0	0	0
9	0	0	317	14473	0	0	0	0
10	0	0	39	15370	154	0	0	0
11	0	0	0	12539	2137	0	0	0
12	0	0	0	659	15469	56	0	0
13	0	0	0	0	12044	0	0	0
14	0	0	0	0	9426	427	0	0
15	0	0	0	0	1927	12744	62	0
16	0	0	0	0	0	2631	350	0
17	0	0	0	0	0	125	2605	16
18	0	0	0	0	0	0	11	113
19	0	0	0	0	0	0	0	163

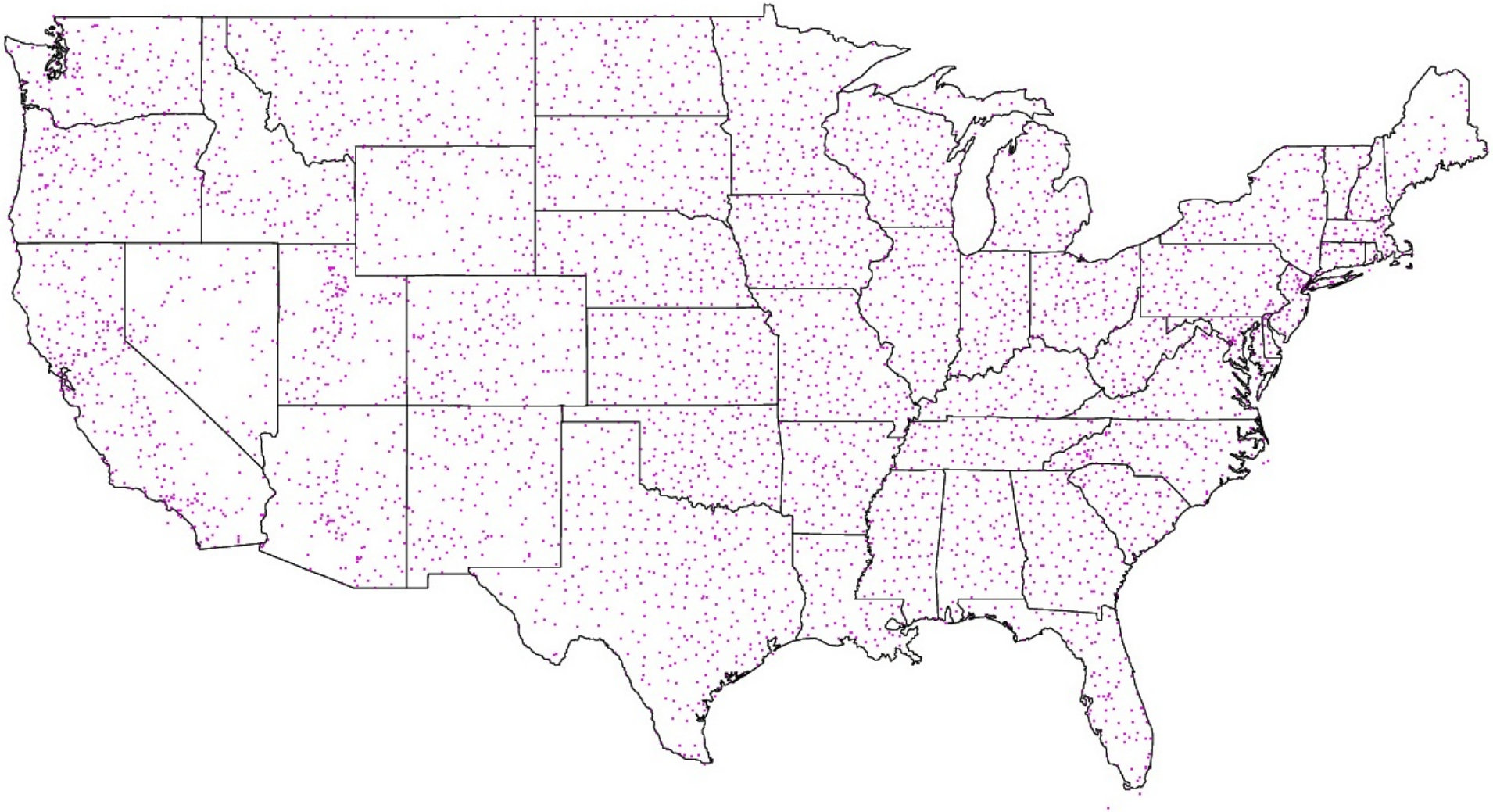
Implications—No more weather manipulation

- Currently in REScheck six states modify their climates by rule ("jurisdictional warming")
- PNNL receives numerous hotline requests related to HDD zone "boundaries"
- E.g., Houston—should HDD be taken from Hobby AP or George Bush AP?
- New code has significantly fewer "boundaries"

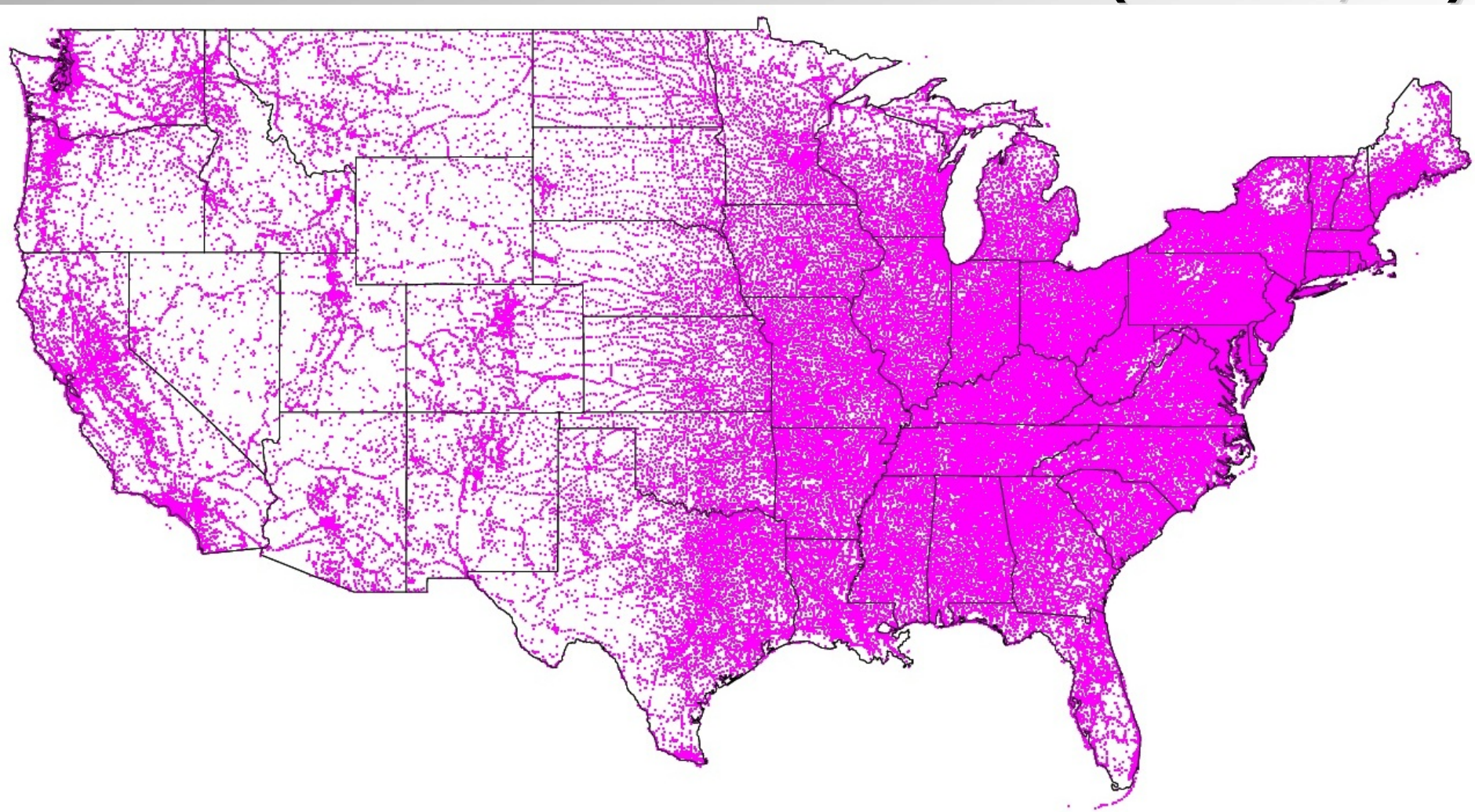
TMY2 Stations (N = 239)



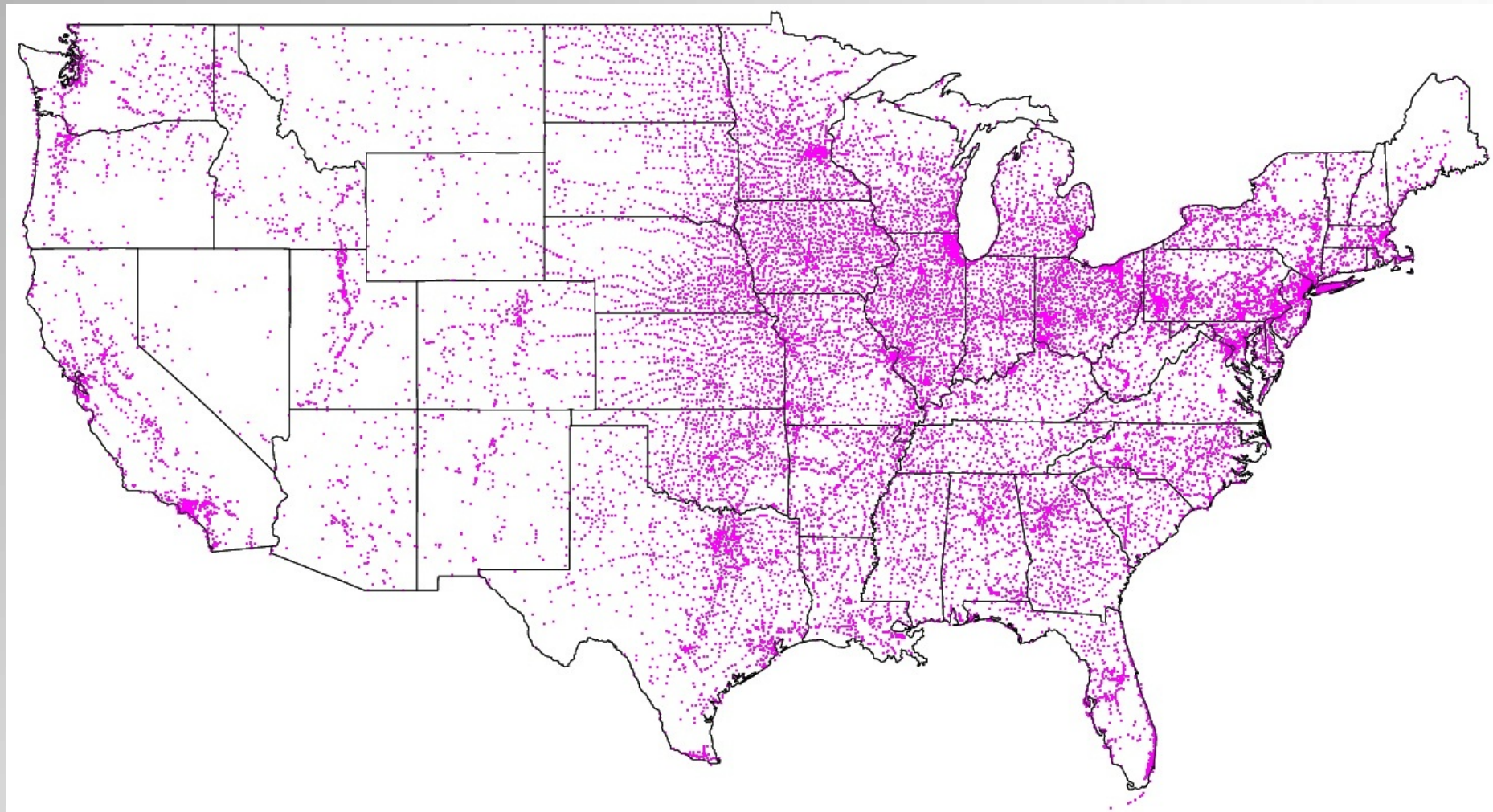
NOAA Stations (N = 4775)



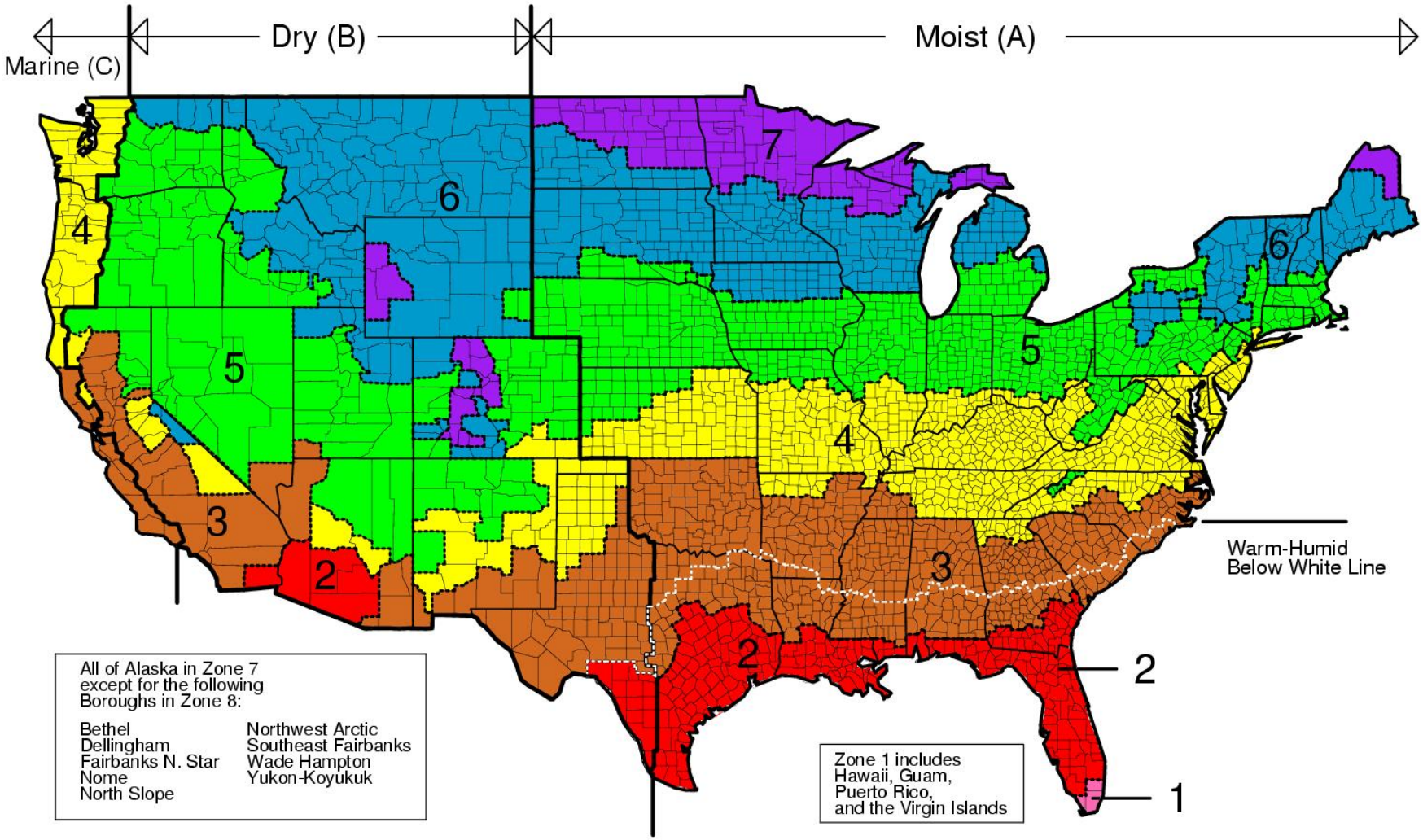
USGS *Populated Places* Data (N = 164,045)



REScheck/COMcheck (N = 22,638)



Map of DOE's Proposed Climate Zones



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Implications—Less *need* for *RES*check

- Simplicity of prescriptive path will reduce the need for any compliance tool
- Simplicity of UA-tradeoff path will reduce the need for software-oriented tool
- *RES*check itself will get simpler

Implications—Less *use* for *RES*check

- Lack of glazing-percentage dependency lessens "motivation" to do trade-offs
- Equipment trade-offs?

Implications—More call for performance compliance

- Simplicity of prescriptive and UA-tradeoff paths will tend to point to performance as route to major departures
- Last hope for "bypasses" (he says quietly)

Implications—Code is ready to accommodate new compliance approaches

- Merging with above- and beyond-code programs
  - Explicitly allowed by code language
  - Simplicity of code reduces number of conflicts with beyond-code programs
- Incorporating HERS compliance paths
  - Similarity of performance path to RESNET rules allows similar tools to be used for both
  - Simplicity of code makes mapping of HERS scores to code compliance easier (not easy, just easier)

Implications—Performance path bypasses will be identified and exploited

- E.g., glazing-percentage credits
- E.g., hydronic distribution systems in the Northeast
- Others?

(eternal vigilance…)

Implications—Trade-off limits will …?

- Strict U/SHGC limits may transform glazing markets (to the chagrin of some mfrs)
- But they also may…
  - complicate the use of some specialty glazings (e.g., garden windows, fancy sidelites)
  - reduce the number of uses for the UA-tradeoff path
  - recuce the number of uses for the performance path
- Intelligence brief: Expect several change proposals from all sides in the next cycle

Implications—Manufacturers may (unwittingly) extend requirements to areas without codes/enforcement

- Homogeneity of requirements will promote economies of scale
- Retail outlets may stock up on the predominately required materials
- Mfrs and retails may eliminate never-mentioned materials (e.g., R-11)

Implications—Training for prior IECC versions may not apply

- Less training needed, but…
- Prior training no longer applicable
- So, 2003 IECC should not be viewed as a stepping-stone to the 2006 IECC

Conclusion

- New code is substantially simpler
- New code is modestly more stringent (on average)
- Expect record numbers of code changes next cycle
- Although Ron Majette will *never* do this again, the RICC represents a major move forward in making energy codes not only stringent but also understandable, practical, enforceable

"*A substantial improvement in usability*"